REMARKS

Election/Restrictions

In the office action dated May 6, 2004 for the instant patent application "Pulse Energy Transformation" (10/082,065), filed 2/26/02, Examiner has determined that the Restriction Requirement previously applied to the claims is proper and FINAL Applicants' traversal stands rejected. Accordingly, elected claims 1-4, 12 will be examined in this application and claims 5-11 considered for a Divisional application to be filed.

Claims Rejections under 35 USC § 112

Examiner has rejected claims 2 and 12 under 35 USC § 112, first paragraph, as failing to comply with the enablement requirement. The Examiner holds that the term"short pulse" is not defined in the specification. Further, it is held unclear whether "short" refers to a frequency or the total exposure time. It is held unclear whether "pulse" refers to an energy pulse (e.g., electrical) or to physical agitation (e.g., flow rate).

Claims 2 and 12 have been rejected by Examiner under 35 USC § 112, second paragraph, as being indefinite. Examiner holds that the term "short pulse energy" in claims 2 and 12 is a relative term which renders the claims indefinite and one skilled in the art would not be reasonably apprised of the scope of the invention. The claims as written do not define the term "short" or distinguish between pulse energy that is "short" compared to that which may be "long".

Applicants' Reply to Rejections under 35 USC § 112

The specification has been amended in the "Summary of the Invention" and in the "Abstract" to incorporate the word "short" in the specification to modify "pulse", relying upon the descriptive use of the word "short" in the original claims. No new matter has been added. The unamended Abstract teaches the use of "pulses of a given *frequency*", now amended to read as "short pulses of a given frequency " .

Line 1 of paragraph 14 of the specification teaches the instant invention operating on the basis of "discrete pulse energy transformation.... " as now included in amended claims 2 and 12. Paragraph 17 of the specification, in its entirety, provides further support for the characterization of the PET pulses as discrete and short.

Applicants' hold that one skilled in the art of mixing technology would be at home with the description of PET pulses as short, discrete and of a given frequency, as now claimed by amendment herein based on the teachings of the specification. Further, enabling and definite illustrations of the dynamics and scope of the working elements of the PET principle are presented in the aforementioned paragraph 17 of the specification, but particularly in the lead paragraph 45 to the section "THE DYNAMICS OF THE VAPOR BUBBLE AS THE WORKING ELEMENT OF NANOSCALE PROCESSES" and subsequent related paragraphs 46-58. These passages provide support for the amendment of claims 2 and 12 and overcome the characterization of the claims 2 and 12 as non-enabling and indefinite to one skilled in the art, as applied by Examiner in the Office Action of May 6, 2004.

Claims Rejection under 35 USC § 102

1. Dolinsky, et al.

Examiner has rejected claims 1-4 and 12 under 35 USC § 102(b) as being anticipated by Dolinskiy et al in the article "The Principles of Developing New Energy-And Resource Efficient Technologies Based On Methods Of Discrete-Pulsed Energy Input" , published in 1999 by Begell House in the Journal of Industrial Heat Engineering, 1999, Volume 1, pp 10-22, . Examiner cites page 12, col,2, paragraph 2; page 13 col. 1, paragraph 3 to col. 2, line 2; page 14, col. 2, paragraph 2 and page 5, col. 2, paragraphs 3 and 4.

Examiner's rejection is respectfully traversed by the applicants' and reconsideration is requested based on the following representation:

In comparison with the article cited, applicants' invention shows that the energy introduced by the PET in the vicinity of any particle of the dispersed liquid

system should exceed the surface energy of the interphase boundary (see equation 1 in the application) between the dispersed particle and the dispersion medium. That is a limiting value for the minimum necessary energy that is being introduced. Applicants' have proposed the equation 3 in the application for the qualitative computation of the necessary energy as a function of the initial dimension of the dispersed particle. Using this tool, one skilled in the art would be more than able to determine the necessary energy applicable to the dispersed particle in any medium

The instant application evaluates the time parameter of the pulse during the application of PET. For example, the specification and Figures show that for a micron sized gassed particle in the liquid this time is of the order of 150 nanoseconds while for a micron particle of a liquid in another non-mixing liquid this time is of the order of 50 ns.

In comparison with the cited article, the instant patent application application shows that PET occurs most efficiently when the pulse energy is used for the perturbation of the interphase surface, its subsequent deformation and finally for the achievement of the break-up of the particle into two or more parts. In comparison with the article, the application shows that the PET energy is used primarily for the destruction of one or more nano-layers whose thickness varies from 1 to several nano-meters of the surface active materials located at the interphase boundary and which impart to it mechanical strength and stability.

In comparison with the cited article, the patent application is the base for achieving a nano-engineering approach which is a principally a new treatment of the subject and different that the treatment presented in the cited article.

In comparison with the cited article, the application deals with the nano-level aspects of PET on the basis of the molecular level from the point of view of quantum mechanics. Concrete examples are given of the quantum mechanical approach to the effects of degasification, emulsification, dispersion, and other engineering and technological processes. Their energetic efficiency is evaluated.

The application presents a means for energy transformation on the nano level in the form of discrete pulses in order to disperse and homogenize a mixture of immiscible liquid components. This is achieved by creating a rapid energy drop in such a mixture by treatment with short energy pulses which lead to the boiling of one or more components of the mixtures and the appearance of intensively developing vapor bubbles. These can be considered as discretely distributed centers of transformation of pulse potential energy due to the pressure drop into kinetic energy of liquid in the vicinity of the bubbles. For the instant invention, it has been discovered that the efficiency of the dynamic and energetic actions on the dispersed phase of the heterogeneous mixture leading to its destruction and decay is determined by the intensively developing vapor bubbles. These create an extremely high velocity of energy transformation and the initiation of thermodynamic and energetic nano-processes in the pulse regime at the inter-phase surface between liquid and vapor. Thus, in the time period from 20 to 80 nanoseconds in the liquid at the boundary of the bubble the pressure changes by 2000 MPa, the temperature changes by two and a half thousand K, acceleration 10 meter/second the density by 10 joule/m and the specific power by 10 M watt/m .

2. Hidaldo (EP534781 A1)

Examiner has rejected claims 1-4 and 12 under 35 USC § 102(b) as being anticipated by Hidaldo as shown in the Abstracts at col. 2, line 20 to Col. 3, line 17; Col. 12, line 47; col. 13, line 23 and in Claim 1.

Examiner's rejection is respectfully traversed by the applicants' and reconsideration is requested based on the following representation:

Applicants' patent application shows that the energy pulses are concretely and necessarily directed to the interphase boundary;

The energy pulse as taught in applicants' patent application is used for the destruction of the nano-mono layer (or several nano layers) of the surface active agents;

The application shows the magnitude of the energy pulse; specifically that it should exceed the surface energy at the interphase. The application also shows the duration of the energy pulse; specifically, that it should exceed the period of self-oscillation at the dispersed particle of the heterogeneous system; that is, of the order of 50-150 ns

Compared to the cited patent, applicants' patent application teaches the nano-scale aspect of the PET principal as applied to attain nano-technology. This is a valuable and important distinction over the patent cited.

The energy pulses of Hidalgo are created by mechanical devices while in applicants' process energy pulses are created by the collapse of vapor bubbles directly at the interphase boundry surface.

In the Hilalg process a high pressure pump must be used at the inlet to the channel in conjunction with baffles, leading to large energy loses. In applicants' process a decrease in energy loses is achieved due to the absence of hydraulic resistance and the need for high pressure pumps is avoided.

3. Gladushnyal, et al. (SU 1688809A1)

Examiner has rejected claims 1-4 and 12 under 35 USC § 102(b) as being anticipated by Gladusnyal as shown in the English Abstract of the Certificate.

Examiner's rejection is respectfully traversed by the applicants' and reconsideration is requested based on the following representations:

The reference process is limited to suspensions or solid particles in the gas flow. Compared to the reference, applicants' process applies to a much wider class of operations including mixing, dispersion and comminution, concentration and homogenate,

In the reference Certificate, the dimensions of the solid particles in the process range from 100--2,000 microns (see page 6 , equation 8 in the patent). In the PET process the dimension of the particles is several orders of magnitude lower which determines its engineering efficiency and nano engineering achievement.

In the reference, the pulse frequency occurs at low frequencies and a narrow frequency range from 2 to 10 hertz while in applicants' process the pulse frequency occurs within a wide range from several hertz to hundred of thousand of kilohertz

and even several megahertz, leading to an appreciably higher frequency of mixing and homogenization.

In the reference, the production of product is very low, between 0.1 liter to 8 liters per minute. Applicants' process achieves high productivity, e.g.,,between 100 and 10,000 kilograms per hour of liquid product. Because of the difference, the process of the reference is precluded from use in the high production applications in which applicants' process is highly effective. This advantage derives from the novel process related attribute of applicants' invention and not merely a matter of arbitrary scale-up

4. Colman et al (US 5,439,991)

Examiner's rejection is respectfully traversed by the applicants' and reconsideration is requested based on the following representation:

When compared with Applicants' PET process the Colman patent has limited applications for suspensions or solid particles in the gas flow while the PET application refers to systems including suspensions, emulsions, aerosols and solid particles in a gas stream.

The present Colman patent refers to processes of mixing, dispersion of solid particles in a liquid stream and/or inclusions of a gaseous phase in a liquid stream; that is, the medium becomes isotropic, one-dimensional with a uniform distribution of inclusions of solid and/or liquid phase. The applicants' PET patent application applies to a much wider class of operations that includes mixing, dispersion and comminution, concentration and homogenization. This leads to the fact, for example, that particles of the inclusions (solid, liquid or gaseous) are not only uniformly distributed in the isotropic one dimensional stream but are also comminuted, decaying into separate particles, and decrease in size; additional comminution and homogenization takes place which is important for the engineering application.

The dimension of the solid particles in the Colman patent ranges from 100-2,000 microns (equation 8 on page 6 of the patent); that is, it is appreciably high

which is frequently not very efficient for various heat and mass transfer technologies. In the application for PET the dimension of the particles is several orders of magnitude lower which determines its engineering efficiency. For example, in operation of applicants' PET invention during vacuum homogenization of milk using the adiabatic boiling effect, the dimension of particles of fat globules range from 1-1.5 microns. Another example, in the operation using a rotor engineering system for mixing and homogenization of soy beans the dimensions of the solid particles range from 40 to 100 microns and the particles of the soy oil from 0.3 to 0.5 microns. In the following example for mixing and homogenization of drilling solutions based on clay and other components, the dimension of particles of kaolin ranges from 20 to 50 nanometers; that is, dispersion occurs within the nanometer level. This means that the nano engineering effect has been achieved.

The pulse frequency occurs in the patent at low frequencies and a narrow frequency range from 2 to 10 hertz while in the PET processes the pulse frequency occurs within a wide range from several hertz to hundreds of thousands of kilohertz and even several megahertz, leading to an appreciably higher efficiency of mixing and homogenization.

In the patent the production of the final product is extremely low and is of the order of 0.1 liter per minute for a liquid stream and about 8 liters per minute for a gas flow. This means that the given patent operates at the low production laboratory sized equipment or for the mixing of special (exotic, expensive, chemically reacting) components. The processes in the PET application operate at high productivities (for example from 100 kilograms/hour to 10,000 kilograms/hour of the liquid product) and in industrial conditions for soy paste, oil drilling solutions, etc.

CONCLUSION

For all of the foregoing reasons, applicants' hold that the claims of applicants' invention, as amended, are unique over the cited references. Reconsideration by Examiner is requested and allowance of the claims as amended is solicited.

The amendment of the specification corrects misspellings and awkward composition. The word "short" is added to the specification based on the use of the word "short" in the claims. No new matter has been added by the amendments to the specification.

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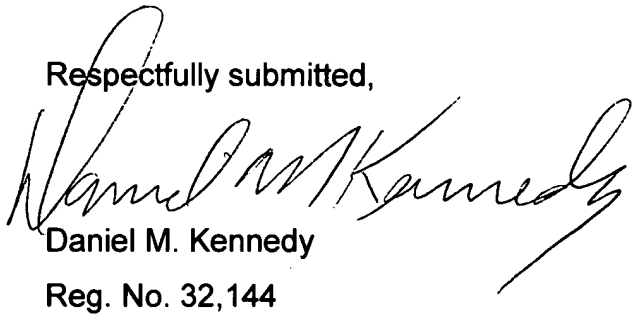
The fees required to be paid to USPTO for the extension of time to reply to the USPTO non-final Office Action mailed May 6, 2004 are to be charged to the credit card of the undersigned in accordance with the completed and signed Credit Card Payment Form PTO-2038 submitted with this reply.

All further communications on this application from the USPTO are to be sent to the undersigned at the address provided.

Respectfully submitted,



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